By Carl Malamud

Transparency Helps Clear Up Networking Issues

One of the last things I do before shipping a book manuscript to my publisher is send out drafts to experts in the networking industry to make sure I haven't made a total fool of myself.

Last time around, one of my reviewers, a pre-eminent authority on computer networks, penciled the following comment next to my chapter on databases: "Not a networking topic . . . delete?"

My immediate response was to get on the phone to every other authority whose number I had to see if I was as off the mark as this reader seemed to think. But while I was soliciting second opinions, I realized that if an industry expert could fail to see how databases were a networking topic, then maybe the issues were not as readily apparent as I first thought.

To be fair, the issue does not simply involve databases. What needs to be assessed are the ways in which remote data access to files and databases involve networking concerns.

THE TRANSPARENCY FACTOR

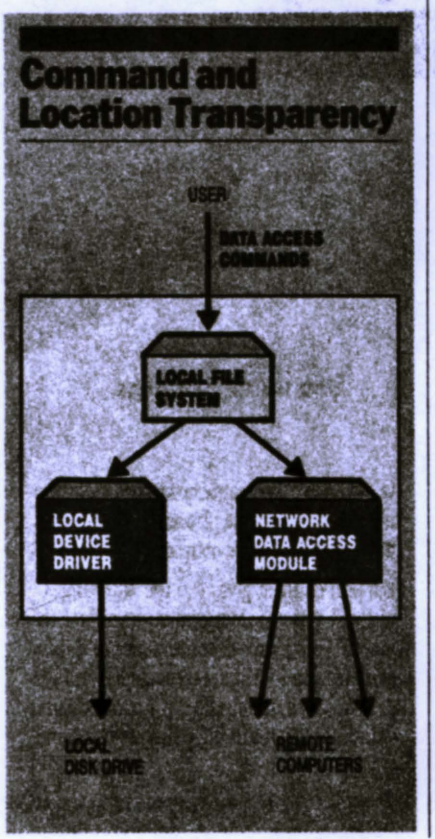
There's no simple answer, but a common thread runs through all relevant discussions—transparency. Any service available locally needs to be transparently available throughout the network.

Such transparency comes at two levels. The lower, command transparency, means the user should be able to work with a familiar command structure when accessing local and remote data. The higher, location transparency, means the user should be unaware of the location of the data (see figure). That's essentially the goal of distributed applications. But the goal is just beginning to be achieved, and it involves two application-level services that are central to distributed applications: databases and distributed file systems.

Let's start with local file access. DEC's Record Management Services (RMS), for instance, is the file system on the VMS operating system. RMS is responsible for accepting a request for a file operation from a client program using a logical identifier (such as DISK1), mapping it to a physical disk drive (such as DUA0), and then fulfilling the request.

RMS also uses a related program, Lock Manager, that decides there are no conflicting operations under way. On a single computer, there are thus two modules used for accessing data: the file system and the lock manager.

When remote machines (and resources) are involved in the DECnet environment, the Data Access Protocol (DAP) is used to extend the local services of RMS across a DECnet. The services provided by DAP are identical to those provided by a native RMS driver.



With a file protocol such as DAP, programmers and users can issue the same command, appending a logical name that specifies where the data resides ("HOST3::DISK1"). But DAP provides command transparency, not location transparency: Users must know at which node of the network (and on which disk drive) the data is located.

Location transparency is furnished by DEC's Distributed File Service (DFS), the equivalent of Sun Microsystems Inc.'s Network File System (NFS). With DFS, all data can appear as a series of logical disk drives or subdirectories independent of any specific physical host.

Given this capability, users can distribute data throughout the network. For example, help files can be put on one machine, then made available to all other users on the network. If the help server breaks, the files can be put on another machine, and a name server notified, without modifying the logical name known by users and applications.

This kind of distributed file system offers the ability to treat all data as a logical whole. No matter which machine on the network a client is on, users always see the same files and logical identifiers.

This is especially important on large networks that must serve tens of thousands of users. It's impossible to assign a workstation to each user—it's simply not cost-effective, and it's impossible to predict on which computer a given user is going to work. Services like DFS and NFS enable users to see their files, no matter which computer they happen to be on.

NETWORKING DATABASES

Clearly, then, the distributed file system is a networking topic. But what about the database? As an extension of the file system, it gives programmers and users a higher-level environment with a more advanced way of accessing data. Many rela-

tional database systems allow the front and back ends to be distributed over the network. Ingres/Net, for instance, lets front and back ends be separated on networks running a variety of protocols—DECnet, TCP/IP, IBM's SNA LU 6.2, Netbios, and plain asynchronous lines.

Separating the front and back ends—termed client-server databases—allows users to access a remote database as long as they know which machine it's physically located on. As with DEC's DAP, though, only command transparency is delivered.

But recent advances have yielded the distributed database, which makes multiple databases appear as if they were a single logical repository of data. In the case of Ingres, that is accomplished by an an add-on program called Ingres/Star. To the application, Ingres/Star looks like one big database server. The application requests data using a structured query language. Actually, the request is broken into a series of smaller requests and sent wherever the data is located. The responses are then put back together to satisfy the user request.

While this architecture sounds simple, there are some very difficult technical issues—many of which are communications-related—that had to be addressed before distributed databases became a reality. Just deciding what order to get the remote data is difficult. For one thing, the query optimizer (the software that decides how to service the request) has to take into account the speed of different machines, the speed of network links, and how much data will be returned using different processing strategies.

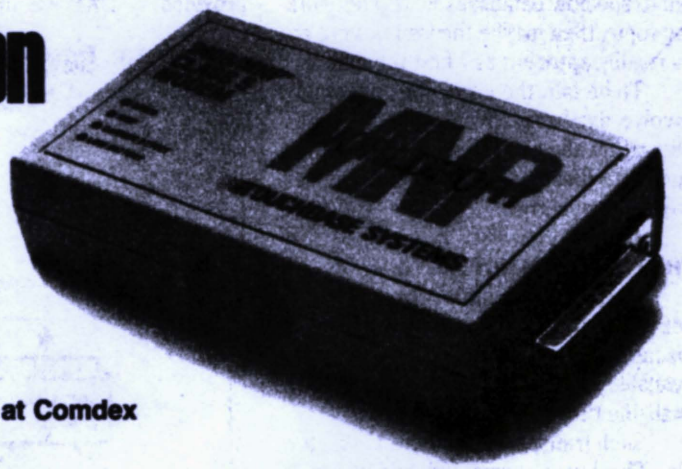
An equally difficult problem is ensuring the integrity of the data in a multistatement transaction. In a distributed database, locking has to be extended to ensure the integrity of transactions that may be split across several machines.

There's one final level of database functionality beyond location transparency. A *gateway* allows a file system or database to look like something else. The Ingres/dBase Gateway products, for example, make other systems look like an Ingres database. Hence, an IBM IMS database or VSAM file, DEC RMS file, or relational systems like DEC's RDB can all take part in an Ingres distributed database.

As I said, there's no simple answer. But discussions like this one help reveal that, viewed from a certain angle, *everything* is a networking topic. In fact, Sun isn't far from the truth when it says "the network is the computer." But of course, when poorly implemented these applications can result in a corollary to the Sun motto: The network is the bottleneck. ■

Carl Malamud is a writer and consultant based in San Francisco and the author of *DEC Networks and Architectures* (McGraw-Hill, 1989) and *Ingres: Tools for Building an Information Architecture* (Van Nostrand Reinhold, 1989).

Avoid Transmission Failures On The Road.



See us at Comdex

Now your data transmission requirements don't have to change just because you're on the move. The WorldPort 2400/MNP® Class 5 Modem gives you high speed data compression and error correction in a fully portable package.

The WorldPort 2400/MNP weighs just 8 ounces, battery included. Yet it's impervious to the pounding and abuse of life on the road. It adapts to Bell and CCITT standards world-wide. And it attaches to practically any public or private phone via RJ-11s or an optional acoustic coupler.

But best of all, it gives you the advantages of speed and accuracy that come only with an MNP modem: the convenience of data compression for higher throughput and the confidence of automatic error correction for data integrity. All in the palm of your hand.

It's travel insurance for those who can't afford transmission problems.

Call us today for the dealer nearest you:

800-541-0345.

(In New York, 516-261-0423.)

Touchbase Systems, Inc.
160 Laurel Avenue
Northport, NY 11768
(516) 261-0423
Fax (516) 754-3491

MNP is a registered trademark of Microcom, Inc. WORLDPORT and TOUCHBASE SYSTEMS are trademarks of Touchbase Systems, Inc. © 1989 Touchbase Systems, Inc.

Circle 34 on Reader Service Card